Aug. 12, 1947. C. W. KUHN ET AL 2,425,623

PROTECTIVE DEVICE

Filed Feb. 4, 1943 2 Sheets-Sheet 1

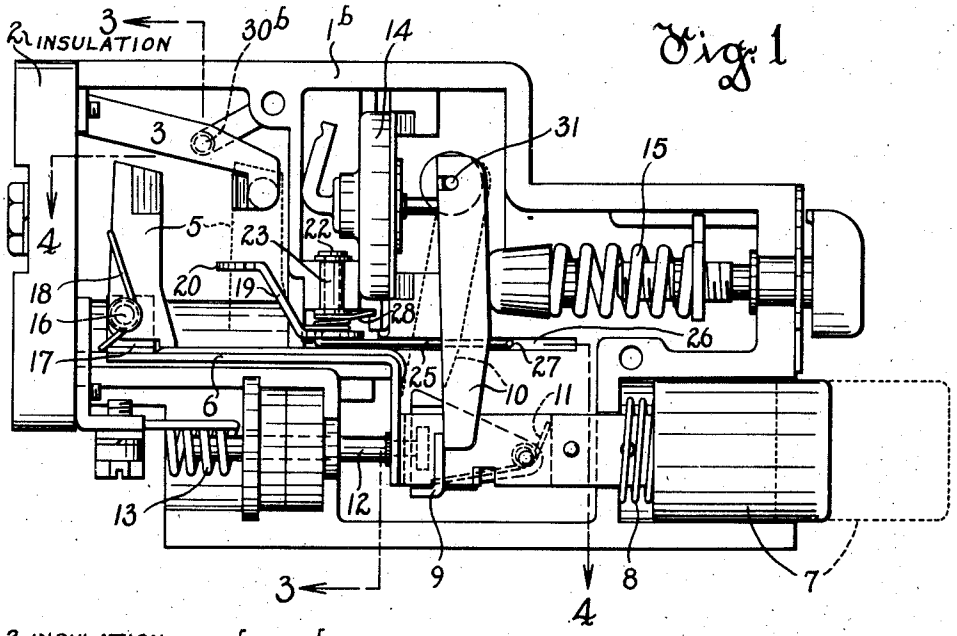


Fig. 1

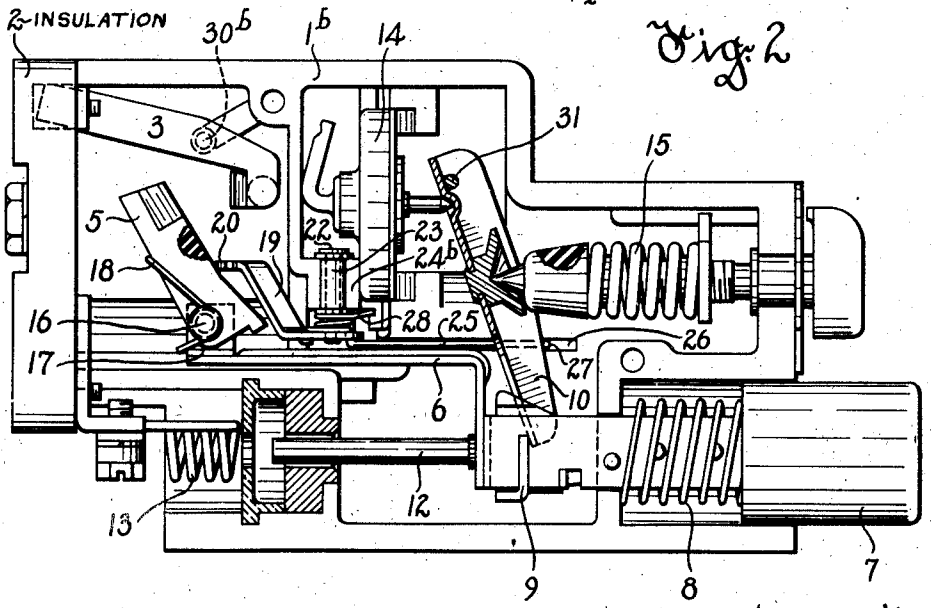


Fig. 2

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Fig. 3

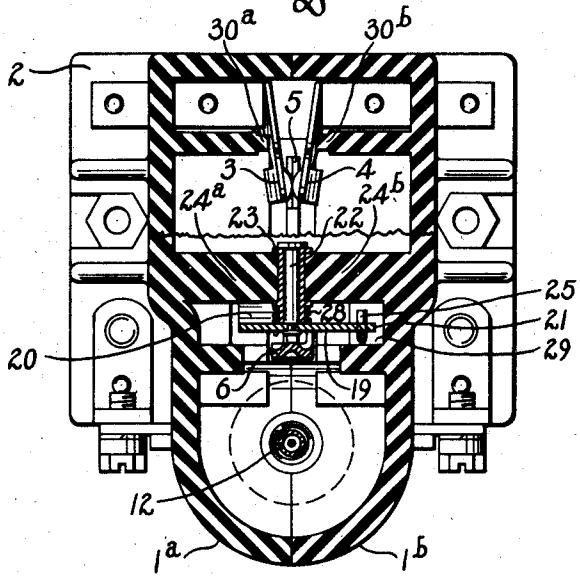
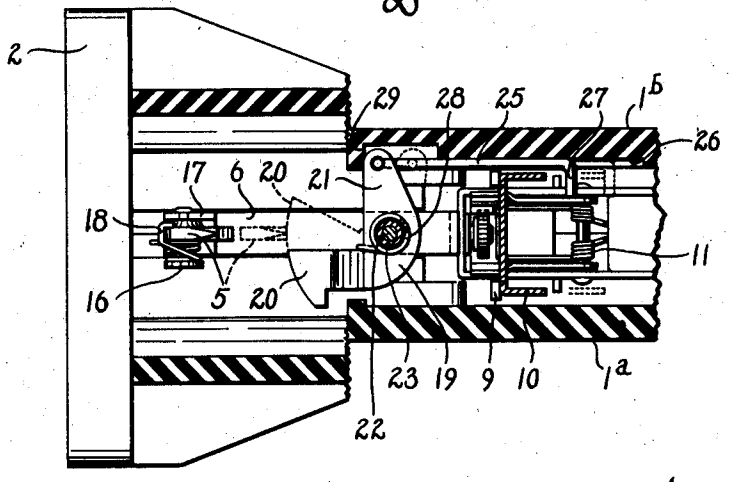


Fig. 4



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PROTECTIVE DEVICE

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7 Claims. (Cl. 200—124)

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This invention relates to protective devices for electric circuits and is particularly applicable to protective devices of the type disclosed in the Kuhn et al. Patent No. 2,310,531, of February 9, 1943.

The aforementioned patent discloses an ambient temperature compensated overload relay, and the present invention has among its objects to provide a relay of this type which is highly shock-proof, or in other words capable of performing properly and withstanding damage when subjected to shocks such as are encountered on board naval vessels upon bombing and torpedoing thereof.

Another object is to provide an overload relay of the aforesaid type with mechanism which acts upon inertial movement of the relay operating mechanism under the action of severe shock to prevent opening of the relay contacts.

Another object is to provide a shock-proof mechanism for relays of the aforesaid type which is simple, rugged and inexpensive in construction and positive and reliable in operation.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that various modifications may be made in the embodiment illustrated without departing from the spirit and scope of the appended claims.

In the drawings,

Figure 1 is a side elevational view of a relay embodying the invention, the relay being shown in set position and a part of the enclosing casing therefor being removed;

Fig. 2 is a view similar to that shown in Fig. 1 with parts broken away and shown in section and illustrating inertial operation of the relay under the action of shock, and

Figs. 3 and 4 are sectional views on lines 3—3 and 4—4, respectively, of Fig. 1.

Referring to the accompanying drawings, the same illustrate an overload responsive relay of the type disclosed in the aforementioned patent, the operating mechanism of said relay being housed between two complementary casing sections 1a and 1b which are formed of molded insulating material and are mounted upon the front face of a vertically disposed insulating base 2.

Briefly described the relay is provided with a pair of normally engaged spring contact fingers 3 and 4 which are mounted upon the front face of insulating base 2 and are separable by an insulating finger 5. Finger 5 is mounted upon a

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bar 6 fixed to a reciprocable push button element 7 and said push button element is slidably supported between the casing sections 1a and 1b and is biased to move forwardly by a spring 8. Push button element 7 is normally held in the depressed position shown by full lines in Fig. 1 to maintain finger 5 out of engagement with contact fingers 3 and 4 by a thermal overload responsive mechanism including a latch 9 and a cooperating vertically disposed lever 10.

Latch 9 is pivotally mounted upon push button element 7 and is normally held against the action of a biasing spring 11 in engagement with the lower end of lever 10 by a solder type thermal responsive element 12. Element 12 is mounted upon push button element 7 and is responsive under the action of a heater coil 13 to trip latch 9 out of engagement with lever 10 upon a predetermined overload current condition in said coil. Upon tripping of latch 9 push button element 7 moves forwardly under the action of spring 8 into the dotted line position shown in Fig. 1 to effect separation of contact fingers 3 and 4 by movement of insulating finger 5 therebetween. Depression of push button element 7 effects resetting of the relay in the position shown in Fig. 1.

Lever 10 has its upper end pivoted upon a pin 31 carried between the casing sections 1a and 1b and said lever is operable by a temperature responsive diaphragm device 14 against the action of an adjustable loading spring 15 to automatically adjust thermal responsive element 12 with respect to heater coil 13 so that overload operation of the relay is substantially uninfluenced by ambient temperature changes.

When the above described relay is in set position severe shock may produce accelerating forces which effect forward movement of push button element 7 and the parts connected thereto against the biasing action of loading spring 15. In accordance with the present invention the mechanism which will now be described is provided for positively blocking insulating finger 5 out of engagement with contact fingers 3 and 4 upon forward movement of push button element 7 under the action of shock.

Insulating finger 5 is pivotally mounted upon a pin 16 carried by an upstanding part 17 fixed to the rear end of bar 6 and is yieldingly held against counterclockwise rotation out of the vertical position shown in Fig. 1 by a spring 18. Upon tripping of the relay under overload conditions spring 18 maintains insulating finger 5 in

the vertical position shown in Fig. 1 during movement thereof between contact fingers 3 and 4.

A bell crank lever 19 having arms 20 and 21 is provided for blocking insulating finger 5 against movement into engagement with contact fingers 3 and 4 upon forward movement of push button element 7 out of the position shown in Fig. 1 under the action of shock. Bell crank lever 19 is fixed to the lower end of a vertically disposed pivot pin 22 and said pivot pin is rotatably supported within a bearing bushing 23 held within an opening formed in the opposing faces of walls 24a and 24b on the interior of casing sections 1a and 1b. Arm 20 extends rearwardly from pivot pin 22 and is bent upwardly for engagement with insulating finger 5 at a point above the pivot pin 16. Arm 21 has a forwardly extending link 25 pivotally connected to the free end thereof and as shown in Fig. 4 said link is located to one side of lever 10 and is slidably supported within a groove 26 in casing section 1b. Link 25 has an inwardly bent portion 27 on the front end thereof to be engaged by lever 10 upon forward movement of said lever beyond the range through which it moves for ambient temperature compensation. Bell crank lever 19 is biased to rotate in a counterclockwise direction (Fig. 4) by a coil spring 28 and said lever is normally held in the position shown in Fig. 4 against the action of said spring by engagement of arm 21 with a stop surface 29 on casing section 1b.

With bell crank lever 19 in the position shown in Fig. 4 the arm 20 thereof is out of the path of insulating finger 5 and the relay is thus adapted to operate as hereinbefore described under overload conditions. However, upon forward movement of the push button element 7 under the action of shock, lever 10 engages projection 27 on link 25 to move bell crank lever 19 in a clockwise direction out of the full line position shown in Fig. 4 so that arm 20 assumes a position in the path of insulating finger 5. This operation occurs prior to movement of insulating finger 5 into engagement with contact fingers 3 and 4. Upon continued forward movement of push button element 7 under the action of shock insulating finger 5 engages arm 20 of bell crank lever 19 and is rotated against the action of spring 18 as shown in Fig. 2 to prevent engagement thereof with contact fingers 3 and 4. As is apparent, rotation of insulating finger 5 against the action of spring 18 permits full movement of push button element 7 against the action of loading spring 15 into the dotted line position shown in Fig. 1 for dissipation of the accelerating forces produced by shock.

As shown in Fig. 3, stationary contacts 3 and 4 are located between projections 30a and 30b on the interior of casing sections 1a and 1b. Said projections prevent separation of contacts 3 and 4 under the action of shock by limiting vibrational movement thereof.

What we claim as new and desire to secure by Letters Patent is:

1. The combination with a switch having operating means biased for movement to effect a given condition of said switch, means engaging a part of said operating means when moved to effect a different given condition of said switch and subjecting said part to a preponderating bias against which it has play under shock, and movable means operating as a function of such play of said part positively to block change in the condition of said switch for a temporary period terminated by subsequent stabilization of said part under said preponderating bias.

2. A condition responsive switch having an associated control mechanism including a member normally movable within a given range and movable beyond said range under an abnormal condition, and means associated with said member for preventing a change in the condition of said switch upon movement of said member beyond said range.

3. In a protective device, in combination, a movable switch element, an operating member therefor biased to move into a given extreme position, a yieldable operating connection between said element and said operating member for moving said switch element into a given circuit controlling position upon biased movement of said operating member into said given extreme position, an overload responsive mechanism for normally holding said operating member out of said given extreme position and for subjecting the same to a preponderating bias against which it has a play under shock, and means operating as a function of said play of said operating part for positively blocking said switch element against movement into said circuit controlling position for a temporary period terminated by subsequent stabilization of said part under said preponderating bias.

4. In a protective device, in combination, a movable switch element, an operating member therefor biased to move into a given extreme position, a yieldable operating connection between said switch element and said operating member for moving said switch element into a given circuit controlling position upon biased movement of said operating member into said given extreme position, an overload responsive mechanism for normally holding said operating member out of said given extreme position and for subjecting the same to a preponderating bias against which it has a play under shock, and means operating as a function of such play of said operating member for positively blocking said switch element against movement into said circuit controlling position, said yieldable operating connection acting upon blocking of said switch element to permit full movement of said operating member into said given extreme position under the action of shock.

5. In a protective device, in combination, a movable switch element, an operating member therefor biased to move into a given extreme position, a yieldable operating connection between said switch element and said operating member for moving said switch element into a given circuit controlling position upon biased movement of said operating member into said given extreme position, an overload responsive mechanism for normally holding said operating member out of said given extreme position and for subjecting the same to a preponderating bias against which it has a play under shock, means operating as a function of such play of said operating member for positively blocking said switch element against movement into said circuit controlling position, said yieldable operating connection acting upon blocking of said switch element to permit full movement of said operating member into said given extreme position under the action of shock, and a temperature responsive device for adjusting said overload responsive mechanism to maintain the action thereof substantially uniform under varying ambient temperature conditions.

6. In a protective device, in combination, a

movable switch element, an operating member therefor biased to move into a given extreme position to move said switch element into circuit interrupting position, a current responsive overload latching mechanism associated with said member, a condition responsive device having a spring biased part normally engaged by said latching mechanism to hold said operating member out of said given extreme position, said spring biased part being adjustable through a given range by said device to vary the current value at which said latching mechanism responds, and being movable against its bias beyond said range under the action of shock, and means associated with said spring biased member and acting upon movement thereof beyond said range to positively block said switch element against movement into circuit interrupting position.

7. In a protective device, in combination, a movable switch element, an operating member therefor biased to move into a given extreme position to move said switch element into circuit interrupting position, a current responsive overload latching mechanism associated with said member, a condition responsive device having a spring biased part normally engaged by said latching mechanism to hold said operating member out of said given extreme position, said spring biased part being adjustable through a given range by said device to vary the current value at which said latching mechanism responds, and being movable against its bias beyond said range under the action of shock, means associated with said spring biased member and acting upon movement thereof beyond said range to positively block said switch element against movement into circuit interrupting position, and a yielding operating connection between said operating member and said switch element permitting full movement of said operating member into said given extreme position under the action of shock upon blocking of said switch element.

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